Claims

What is claimed is:

1. An apparatus for measuring relative humidity of a mixture comprising:

a chamber having a chamber volume and an opening;

a membrane covering the opening, the membrane being permeable to water vapor while impermeable to liquid water;

a humidity sensor in the chamber volume for producing a first signal relating to relative humidity of the mixture within the chamber volume;

a first temperature sensor for producing a second signal relating to temperature of the mixture within the chamber volume;

a second temperature sensor for producing a third signal relating to temperature of the mixture at a point exterior to the chamber; and

a processor coupled to the humidity sensor, the first temperature sensor, and the second temperature sensor for receiving the first, second, and third signals, the processor programmed to calculate relative humidity of the mixture at the point exterior to the chamber as a function of the first signal, the second signal, and the third signal.

2. The apparatus of claim 1 wherein internal surfaces of the chamber are constructed of a nonabsorbent material.

3. The apparatus of claim 2 wherein the chamber is entirely constructed of the nonabsorbent material or the internal surfaces are a coating of nonabsorbent material.

4. The apparatus of claim 2 wherein the nonabsorbent material is a metal.

5. The apparatus of claim 2 wherein the nonabsorbent material is selected from a group consisting of brass, gold, tin, bronze, silver, platinum, and lead.

6. The apparatus of claim 1 wherein the first temperature sensor is located within the chamber volume.

7. The apparatus of claim 1 further comprising:

a housing having an internal volume and a breather hole;

the chamber mounted in the internal volume of the housing so that the membrane is aligned with the breather hole; and

the second temperature sensor being located exterior to the internal volume of the housing.

8. The apparatus of claim 7 wherein the first temperature sensor is located exterior to the chamber but within the internal volume of the housing.

9. The apparatus of claim 7 further comprising an O-ring positioned between the membrane and the housing so as to form a sealed fit between the membrane and the housing.

10. The apparatus of claim 7 wherein the second temperature sensor is located in a passageway extending through the housing.

11. The apparatus of claim 7 wherein the housing is adapted to be a hand held meter.

12. The apparatus of claim 1 wherein the membrane is constructed of microporous hydrophobic polymeric material.

13. The apparatus of claim 1 wherein the membrane covers the opening of the chamber so as to isolate the chamber volume from ambient air.

14. The apparatus of claim 1 wherein the first temperature sensor and the second temperature sensor are thermistors.

15. The apparatus of claim 14 wherein the thermistors are matched.

16. The apparatus of claim 1 wherein the humidity sensor and the first temperature sensor are combined on a single substrate located within the chamber volume.

17. The apparatus of claim 1 wherein the chamber is cylindrically shaped having a first end and a second end, the membrane forming the first end of the chamber and a portion of a circuit board forming the second end of the chamber.

18. The apparatus of claim 17 wherein the portion of the circuit board that forms the second end of the chamber is coated with or constructed of a nonabsorbent material.

19. The apparatus of claim 18 wherein the nonabsorbent material is selected from the group consisting of brass, gold, tin, bronze, silver, platinum, and lead.

20. The apparatus of claim 1 wherein the chamber volume is in the range from approximately 0.5 to approximately 2.0 ml.

21. The apparatus of claim 1 further comprising a housing having an internal volume and a hole; the chamber mounted in the internal volume of the housing so that the membrane is aligned with the hole; the second temperature sensor being located exterior to the internal volume of the housing; the first temperature sensor being located exterior to the chamber but within the internal volume of the housing; an O-ring positioned between the membrane and the housing so as to form a sealed fit between the membrane and the housing; the second temperature sensor located in a passageway extending through the housing; wherein the first temperature sensor and the second temperature sensor are matched thermistors; wherein the chamber volume is in the range from approximately 0.5 to approximately 2.0 ml; and wherein the chamber is constructed of a metal.

22. An apparatus for obtaining measurements of a mixture comprising:

a chamber having internal surfaces constructed of nonabsorbent material, the internal surfaces forming a chamber volume;

an opening in the chamber;

a membrane covering the opening, the membrane being permeable to water vapor while impermeable to liquid water; and

a humidity sensor in the chamber volume for producing a first signal relating to relative humidity of the mixture within the chamber volume.

23. The apparatus of claim 22 further comprising a first temperature sensor for producing a second signal relating to temperature of the mixture within the chamber volume; and the humidity sensor and first temperature sensor adapted to be coupled to a processor for receiving a set of signals comprising the first and second signals.

24. The apparatus of claim 23 further comprising the processor, the processor coupled to the humidity sensor and the first temperature sensor and programmed to calculate relative humidity of the mixture at a point as a function of the set of signals.

25. The apparatus of claim 24 further comprising a second temperature sensor for producing a third signal relating to temperature of the mixture at the point, the processor coupled to the second temperature sensor; the set of signals further comprising the third signal; and the point being exterior to the chamber.

26. The apparatus of claim 23 wherein the nonabsorbent material is a metal.

27. The apparatus of claim 23 wherein the nonabsorbent material is selected from a group consisting of brass, gold, tin, bronze, silver, platinum, and lead.

28. The apparatus of claim 23 wherein the chamber is cylindrically shaped having a first end and a second end, the membrane forming the first end of the chamber and a portion of a circuit board forming the second end of the chamber.

29. The apparatus of claim 28 wherein the portion of the circuit board that forms the second end is coated or constructed with a nonabsorbent impermeable material.

30. The apparatus of claim 29 wherein the nonabsorbent material is a metal.

31 The apparatus of claim 29 wherein the nonabsorbent material is selected from a group consisting of brass, gold, tin, bronze, silver, platinum, and lead.

32. The apparatus of claim 23 wherein the chamber volume is in the range of approximately 0.5 to approximately 2.0 ml.

33. A method of measuring relative humidity of a mixture comprising:

providing an apparatus having a chamber having a chamber volume and an opening, a membrane covering the opening, the membrane being permeable to water vapor while impermeable to liquid water;

measuring humidity of the mixture within the chamber volume with a first sensor;

measuring temperature of the mixture within the chamber volume with a second sensor;

measuring temperature of the mixture at a point exterior to the chamber with a third sensor; and

calculating relative humidity of the mixture at the point exterior to the chamber with a processor as a function of the measurements obtained by the first sensor, the second sensor, and the third sensor.

36. The method of claim 35 wherein internal surfaces of the chamber are constructed of nonabsorbent material.

37. The apparatus of claim 36 wherein the chamber is entirely constructed of the nonabsorbent material or the internal surfaces are a coating of nonabsorbent material.

38. The method of claim 36 wherein the nonabsorbent material is a metal.

39. The method of claim 38 wherein the metal is selected from a group consisting of brass, gold, tin, bronze, silver, platinum, and lead.

40. The method of claim 36 wherein the chamber is cylindrically shaped having a first end and a second end, the membrane forming the first end of the chamber and a portion of a circuit board forming the second end of the chamber.

41. The method of claim 40 wherein the portion of the circuit board that forms the second end of the chamber is coated or constructed with the nonabsorbent material.

42. The method of claim 35 wherein the chamber volume is in the range of approximately 0.5 to approximately 2.0 ml.